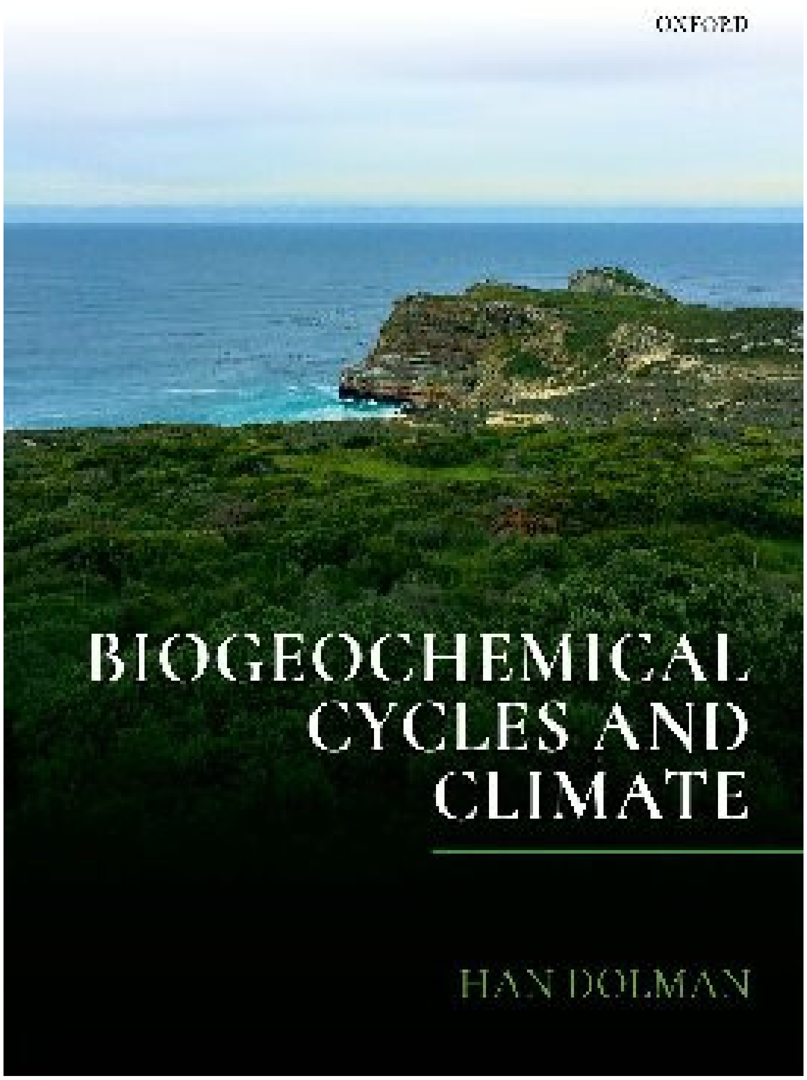

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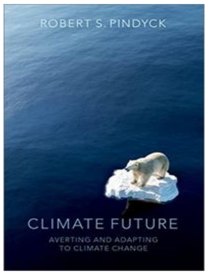

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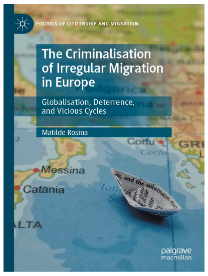

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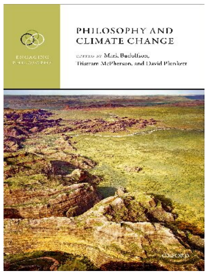

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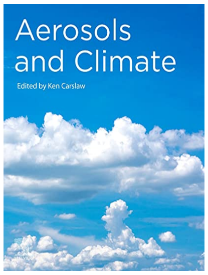

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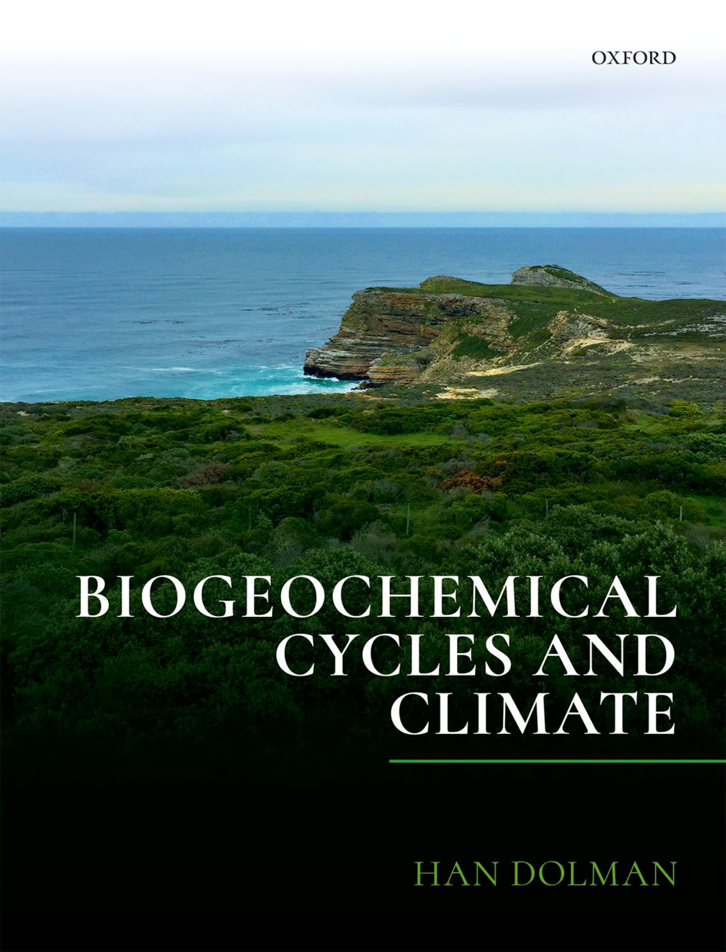

BIOGEOCHEMICAL CYCLES AND CLIMATE

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Biogeochemical Cycles and Climate

Han Dolman

Vrije Universiteit Amsterdam

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Preface

It was at the annual meeting of the European Geosciences Union in Vienna in 2014 that I was approached by Sonke Adlung from Oxford University Press with the question if any and, if so, what book was missing in my field of research. I think now that I did not immediately reply, but that it took me some time before I was able to clearly identify what was missing. The reasons for that lie in my experience of having taught Earth science students the basic physics of climate for some time, and in the fact that Earth science itself provides numerous beautiful examples of how that physics and biogeochemistry operated in the geological past, aspects which I did not teach. I needed some time to formulate the importance of presenting these together.

Most university courses present our students with a rather incomplete picture of the climate of our planet. Meteorology students are made familiar with the physics of the interaction of greenhouse gases and radiation, and the thermodynamics and transport of the atmosphere, but generally lack knowledge of the role of oceans and the interaction of the biosphere with climate. They also miss a palaeoclimatological perspective. Earth science students gain insight into long-term climate processes such as the geological thermostat, the role of plate tectonics in climate and various other aspects of palaeoclimate and biogeochemistry but are hardly made familiar with the physics of atmosphere and ocean.

The societal implications of this development are severe. We can only understand climate (change) as long as we can quantify the multitude of feedbacks between these important physical and biogeochemical and biological processes. This requires understanding not only what processes change the rates and magnitudes of biogeochemical cycles such as the carbon cycle, the nitrogen cycle and the water cycle but also how the physics of motion, thermodynamics and radiation respond to those changes.

This book follows from these considerations. It is about the science of the interactions and the exchange processes between reservoirs such as the ocean, the atmosphere, the geosphere and the biosphere. It is less about the human impact, as there is already a wealth of good textbooks that deal with issues of current climate change such as adaptation, mitigation and impacts. The book is primarily aimed at Earth science students who are at the advanced-bachelor's or master's level and have a basic understanding of algebra, chemistry and physics. Its purpose is not at all to be complete. It aims rather to provide a more integrated view of the climate system from an Earth science perspective. The choices of the subjects are, however, my own and based on personal and probably biased preferences. It is up to the reader to judge how well I succeeded in this complicated attempt at integration.

The first three chapters offer a general introduction to the context of the book, outlining the climate system as a complex interplay between biogeochemistry and physics

and describing the tools we have to understand climate: observations and models. They describe the basics of the system and the biogeochemical cycles. The second part consists of four chapters that describe the necessary physics of climate to understand the interaction of climate with biogeochemistry and change. The third part of the book deals with Earth's (bio)geochemical cycles. These chapters treat the main reservoirs of Earth's biogeochemical cycles—atmosphere, land and ocean—together with their role in the cycles of carbon, oxygen, nitrogen, iron, phosphorus, oxygen, sulphur and water and their interactions with climate. The final two chapters describe possible mitigation and adaptation actions, always with an emphasis on the biogeochemical aspects. I have tried to make these last six chapters as up to date as possible by providing more references in them than in the previous chapters.

I am grateful to Sonke Adlung for posing that initial question to me in 2014. He and Ania Wronski at Oxford University Press have always been very supportive of the project, even when the start was somewhat difficult. John Gash, former colleague and lifelong friend, edited the first draft. Various colleagues at the Department of Earth Science of the Vrije Universiteit have provided feedback, both on ideas and on chapters. Gerald Ganssen has always been a great stimulating force for this project and I very much appreciate his role as discussion partner providing the larger-scale geological perspective. I sincerely acknowledge the freedom I experienced in the Department of Earth Sciences to be able to write and finish this book as I wished. Further support was received from the Darwin Centre for Biogeology and the Netherlands Earth System Science Centre. Several people have commented on individual chapters: Antoon Meesters, Jan Willem Erisman, Joshua Dean, Sander Houweling Nick Schutgens, Appy Sluys and Jack Middelburg. Ingeborg Levin and Martin Heimann read the near-final draft. It is fully due to these people that several (embarrassing) errors have been corrected in time. I very much appreciate the opportunity provided by the president of the Nanjing University of Information Science and Technology and by Tiexi Chen and Guojie Wang to spend some time at Nanjing in the spring of 2018, that allowed me to finish the book. Kim Helmer was of great help in obtaining copyright permissions for the various figures used in this book.

The writing of this book took quite some time, but was overall a very enjoyable experience. I like to thank my lifelong partner Agnes and my two sons Jim and Wouter for their support. Words are simply not enough to express my gratitude to them.

Han Dolman
June 2018

Contents

1

Introduction

1.1 Biogeochemical cycles, rates and magnitudes

The movement of matter and transfer of energy around the planet plays a fundamental role in Earth's system. It ensures that Earth is habitable and also determines the availability of key resources for human use. Take, for instance, the availability of fossil fuels such as the hydrocarbons oil and gas. The large-scale exploitation of these fossil fuel reserves has enabled Earth's population to develop on an incredibly fast economic growth trajectory that has brought us great wealth and progress. However, the waste products of this fossil fuel use, primarily in the form of carbon dioxide and methane, are causing large-scale perturbations in Earth's climate. These have been assessed by the Intergovernmental Panel for Climate Change (IPCC) in a series of groundbreaking assessment reports, documenting rising sea levels, increasing temperatures, changing weather patterns, heatwaves and drought. In geological history, some of the greenhouse gases that are now playing havoc with the climate have played an essential role in regulating Earth's temperature and created the conditions for life to evolve. At these long timescales, without human interference, the carbon atoms in carbon dioxide and methane molecules would be continuously recycled in Earth's geological cycles. Variations in the rate of biogeochemical cycling are key to understanding past climate variability and today's climate change.

The rate and magnitude of biogeochemical cycling also determine the availability of food for humans, as the large-scale application of artificial fertilizer shows. Haber invented the process for the industrial production of ammonia from atmospheric nitrogen in 1908; since then, many more people on Earth have been fed, particularly in the period after the Second World War. The concomitant population explosion has, however, happened at the cost of substantial changes to the biogeochemical cycle of nitrogen and to the environment, to the extent that now the nitrogen cycle is dominated by input from anthropogenic processes. Environmental effects include contamination and eutrophication of freshwater bodies, and excessive atmospheric deposition and emissions of a potent greenhouse gas, nitrous oxide.

The Russian scientist Vladimir Vernadsky is generally credited with defining the notion of the biosphere in his landmark 1926 book, the Biosphere and the associated biogeochemical cycling of material and energy within the biosphere (Vernadsky, 2012). In his view, the biosphere is one of Earth's concentric envelopes, containing not only life

Biogeochemical Cycles and Climate. Han Dolman, Oxford University Press (2019). © Han Dolman.
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but also the minerals that are cycled through the activity of life and geological processes. He was the first to entertain the notion that the composition of the atmosphere was in some way regulated by life. One could argue that he identified living matter as a geological force in its own right, a concept that has now found its human equivalent in the modern concept of the Anthropocene (Crutzen, 2002).

The impact of biogeochemical cycles on climate and vice versa can conveniently be phrased as three questions:

- How have the cycles of key nutrients, such as carbon, nitrogen and phosphorus, and water changed, both in the geological past and, more recently, through the impact of humans on the Earth system?
- How do these cycles interact with each other and the physical properties of climate?
- How can we use this knowledge to mitigate some of the impacts of the changing biogeochemistry on climate, and Earth's habitability and resilience?

This book is about these three aspects of biogeochemical cycling and Earth's climate. Understanding the exchange of materials and its relation to climate is important, in particular if these exchanges involve radiatively active trace gases such as carbon dioxide, methane and nitrous oxide. Through their absorption characteristics in the infrared radiation domain, these trace gases directly interact with the climate.

While the geological forces that have shaped the environment over millions and billions of years impact the size and availability of fluxes and reservoirs, geology also provides key signature information on changes in biogeochemical cycles, through long-term records of the composition and abundance of specific minerals and isotopes in sediments and rocks. These records are not always straightforward or easy to interpret; however, the geological memory is an important asset in providing the larger picture of the interaction between biogeochemistry and climate. We will take this double-sided perspective in this book: Earth science is both our tool and our study object.

1.2 The geological cycle

One of the important characteristics of Earth is its continuous recycling of rocks, soils and material through what is known as the geological cycle. The geological cycle is traditionally described as a set of four related cycles: the tectonic cycle, the rock cycle, the hydrological cycle and the biogeochemical cycles. The last two figure prominently in this book. Virtually all of these cycles are, in some way, interlinked but they differ in the timescales at which key processes occur. The tectonic cycle involves the creation and destruction of the lithosphere (Earth's outer layer, which is roughly 100 km deep) through a process called plate tectonics. Not all planets have this phenomenon, at present, it appears to be a unique feature of Earth. Planetary geologists still debate why Earth is the only planet in the solar system with active plate tectonics. Plate tectonics operates at timescales of tens of millions of years and involves the movement of large

plates on a substrate of denser material at speeds of 0.020–0.150 m yr^{-1} depending on the plate and geological period. On the one hand, the tectonic cycle involves the creation of new materials, or lithosphere, at oceanic ridges, in a process called 'sea-floor spreading'. On the other hand, it involves the destruction of these in 'subduction zones', where an oceanic plate dives, or subducts, due to its larger density, beneath a lighter continental plate. Subduction zones are the places with the most active volcanoes and where seismic activity is strongest. Where tectonic plates of similar density meet, mountain ridges are produced as a result of the collision; the Himalayas and the Rocky Mountains are prime examples of this. Plate tectonics shapes the continents, oceans and mountain ridges of the planet, and has an important impact on climate—not least because the placement of continents affects the ocean circulation. Plate tectonics provides the critical recycling mechanism for materials in Earth's crust.

Trace gases such as carbon dioxide and methane, but also water vapour, define the radiative properties of the atmosphere, keeping the global tropospheric temperature well above freezing. On Earth, water can exist in its frozen, liquid and vapour forms and this is a prerequisite for life as we know it. Carbon dioxide is only present in Earth's atmosphere in small quantities, with its concentration typically expressed in parts per million. This is fundamentally different to our neighbouring planets Venus and Mars, which both have atmospheres comprising more than 95% carbon dioxide. It is estimated that, if there had not been life on Earth, its atmosphere would contain 98% carbon dioxide. The amount of carbon in Earth's atmosphere is, however, marginal compared to the quantities of carbon locked up in the deep Earth, sediments and ocean reservoirs.

It is worth emphasizing these differences between the carbon stocks of the surface reservoirs and the stores of carbon in Earth's core, mantle and continents. Earth's core is estimated to contain 4 billion petagrams of carbon (Pg C; 1 Pg = 10^{15} grams), which is 90% of the total amount of Earth's carbon, an enormous 1 million times more than the three surface reservoirs together (DePaolo, 2015). This deep carbon does not exchange with the other reservoirs but has probably played an important role in establishing climate on the very young Earth, some 4.5 billion years ago. Earth's mantle contains about 240–400 million Pg C, roughly 8%–9% of the total amount of Earth's carbon. This carbon appears as diamonds and impurities in minerals. About a quarter, 60–70 million Pg, of this is located in Earth's crust, forming the continents and the ocean floor. Its main forms are limestone and dolomite, and its pressurized form is marble. This carbon may be released from the crust to the atmosphere through volcanism and geysers.

1.3 The carbon cycle

To illustrate the impact of biogeochemistry on climate, let us pay some further attention to the carbon cycle. The biggest game-changing event in Earth's biogeochemical history was arguably the production of organic matter and oxygen by cyanobacteria, algae and green plants (Langmuir & Broecker, 2012). In the presence of solar radiation,

$$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2 \tag{1.1}$$

This equation is fundamental to our understanding of the carbon and oxygen cycle, past and present, and we will come back to it numerous times in this book. It describes the production of oxygen and sugars through oxygenic photosynthesis. The subsequent reverse process, respiration, consumes oxygen and sugars in an exothermic reaction. To a large extent, the balance of these two processes determines the size of surface reservoirs of carbon and oxygen. However, interactions with other geological processes, such as reactions with reduced materials from Earth's crust (e.g. sulphur and iron) or the burial of organic matter, can take carbon temporarily out of the equation and shift the equilibrium towards the right, thus increasing the amount of oxygen. Of course, the opposite can also happen. That part of the carbon cycle where this equation plays the central role is named the organic carbon cycle (see Figure 1.1). We will see later that its importance in regulating climate depends on the timescale we look at and that it cannot explain all the variability of the geological record (see Chapter 9). For that, we also need to look at another part of the carbon cycle.

This other part, the inorganic carbon cycle, is often called Earth's geological thermostat and is shown schematically in Figure 1.2. It describes how, in its solid form, calcium carbonate is in a subtle exchange process with carbon dioxide in the atmosphere. The rate of exchange between atmosphere, ocean and crust appears to control climate at million-year timescales. It is dependent—as the name suggests—on the geological cycle, but it is also dependent on the availability of liquid water in the hydrological cycle. Weathering of exposed rock surfaces, either physically, by freezing and cracking, or chemically, by dissolution, produces smaller particles of these rocks; these particles are then transported by wind, water or ice. When these materials collate together and sink to the floor of the ocean basins, sediments are produced. The weight of the new sediments

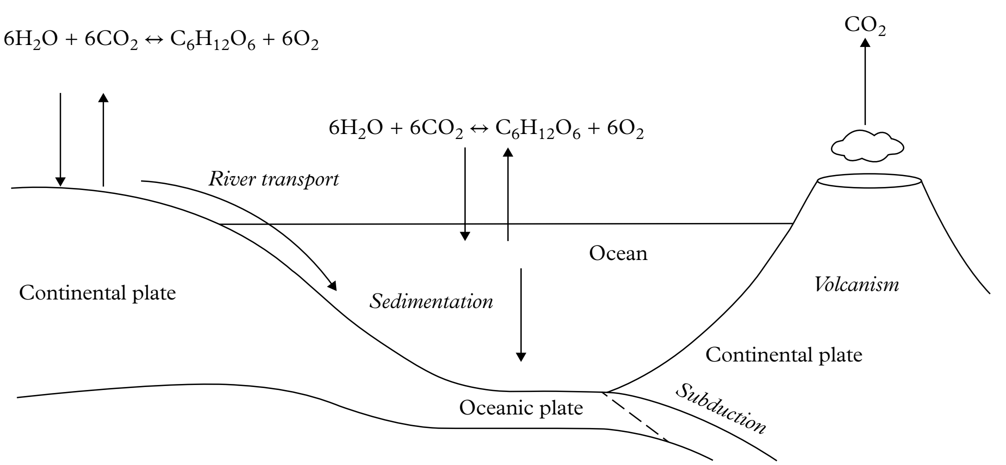

Figure 1.1 *The organic carbon cycle based on the conversion of carbon dioxide and water into oxygen and sugars (biomass). The speed at which the sediments are buried and subsequently returned to the atmosphere through subducting plates that emit volcanic carbon dioxide links the organic carbon cycle to the tectonic cycle.*

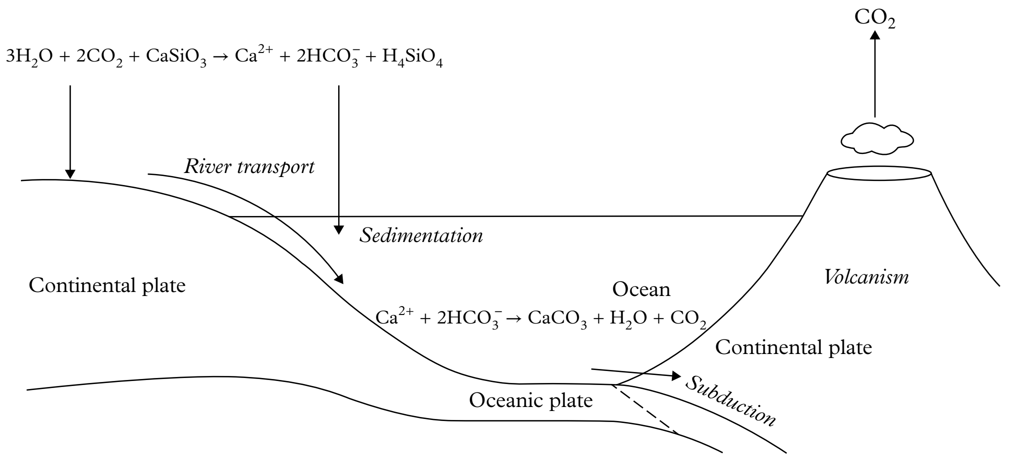

Figure 1.2 *The inorganic carbon cycle containing the geological thermostat. The speed at which the sediments are buried and subsequently returned to the atmosphere through subducting plates that emit volcanic carbon dioxide then determines the net long-term balance of carbon dioxide in the atmosphere.*

compacts the underlying layers further until sedimentary rocks are produced. These then enter the tectonic cycle and may be transformed by heat and pressure into metamorphic rocks or lifted up to the surface by plate tectonics, where a new cycle of weathering can start. The ocean, in particular the deep ocean, thus plays a key role in linking the fast and slow carbon cycles.

A closer look at the chemistry of water, carbon and the rocks of the inorganic carbon cycle shows the fundamental importance of this part of the carbon cycle on geological timescales (Langmuir & Broecker, 2012). Water falling on Earth's land surface lets rocks and soil react chemically with the main minerals, calcium and silicate:

$$3H_2O + 2CO_2 + CaSiO_3 \rightarrow Ca^{2+} + 2HCO_3^- + H_4SiO_4 \tag{1.2a}$$

$$Ca^{2+} + 2HCO_3^- \rightarrow CaCO_3 + H_2O + CO_2 \tag{1.2b}$$

Equation (1.2a) shows how water and carbon dioxide act together to dissolve the calcium silicate (the mineral wollastonite) to produce calcium and carbonate ions and a silicate. In today's ocean, calcium is used to form the shells of small unicellular and multicellular organisms that ultimately sink down to the ocean floor. In the absence of these organisms, the calcium and bicarbonate ions react to give calcium carbonate that then precipitates to the ocean floor (eqn (1.2b)).

The reason why these equations are so important in controlling Earth's climate is that the dissolution of one molecule of wollastonite occurs at the cost of precisely one molecule of carbon dioxide (note that there are two molecules of carbon dioxide going in on the left side of eqn (1.2a) but only one coming out on the right side of eqn (1.2b)). This provides a mechanism for the effective removal of carbon dioxide from the

atmosphere by Earth's crust. But this is not the full story: eqn (1a) also shows the importance of water. If there is more water, that is, in the form of precipitation, the weathering rate should go up and thus also the amount of carbon dioxide removed from the atmosphere. Higher temperatures can lead to increased precipitation by increasing the water-holding capacity of the atmosphere. If the atmospheric concentration of carbon dioxide increases, the temperature goes up and thus more carbon dioxide is removed. If the temperature goes down, the opposite happens, and the carbon dioxide concentration in the atmosphere, and the temperature, will go up. This feedback loop is thought to be the main regulator of Earth's climate at geological timescales and shows how intricately water, the carbon cycle and climate are linked: the main thesis of this book. The fact that it operates at a geological timescale makes testing and finding hard evidence problematic, so it is best considered a (very) likely hypothesis (but see also Chapter 12).

The inorganic carbon cycle operates at timescales of millions to billions of years and is of little use to the current increase in carbon dioxide due to the use of fossil fuels. Indeed, on top of this slow inorganic cycle operates a much faster carbon cycle (Ciais et al., 2013). Here, fluxes of carbon involve the uptake of carbon by plants through photosynthesis, its subsequent respiration (eqn (1.1)) both on land and in the ocean, and the uptake of carbon dioxide by the ocean. The fluxes of this part of carbon cycle impact the surface stores of Earth, the carbon reservoirs of ocean, land and atmosphere. By far the largest amount of carbon is stored in the ocean, about 40,000 Pg C. The amount of carbon stored on land is tiny in comparison, a mere 500 Pg C in the biomass and 3–4 times that in the soil (pre-industrial numbers), with an additional 1,700 Pg C locked up in the soils of the permafrost areas, mostly in Siberia (see Chapter 10). In the atmosphere, the third exchange reservoir, the amount stored is comparable to that of biomass on land, about 500 Pg C.

Compare these minute amounts with those we mentioned earlier for the deep Earth and crust; they comprise a mere 1%–2% of the total carbon reserves of Earth. However, the carbon in the smallest of these, the atmospheric reservoir, and in concentrations of carbon dioxide in parts per million, provides the key to climate and how it changes in the short term. In the longer term, the oceans' uptake capacity and their ability to transport carbon dioxide to their deeper layers, the ocean sediments, and, on a much longer scale, tectonic movements and volcanism are the important players.

1.4 Feedbacks and steady states

Feedbacks such as that of the geological thermostat, as well as from the burial of organic matter, play a crucial role in the complex system of Earth's climate. A feedback either dampens or strengthens an original signal. Negative feedbacks stabilize a system; positive feedbacks amplify initial perturbations. For a feedback to occur, several components are needed: an initial signal, a process that responds to this signal, and an amplifying or dampening mechanism. A classic example in climate science is the ice–albedo feedback. Ice has a high albedo and thus reflects a large amount of sunlight, substantially more so than open water or land. The ice surface therefore stays cool relative to open water or land.

If the temperature increases (the signal), more ice can melt (the process in the feedback loop). This results in more open water and ice-free land, and even higher temperatures, which cause even more ice to melt. This kind of feedback, where an initial signal is amplified over and over again, is a positive feedback loop. One example of a negative feedback is growing-season phenology: here, warmer temperatures extend the growing season, leading to more photosynthesis. The increased carbon drawdown can act to reduce the amount of warming. Here, the signal is the temperature of the atmosphere, the process is photosynthesis and the result is a dampening of the initial signal.

In a steady state, the size of the reservoir and the magnitude of the fluxes do not change. Cycles involving exchange fluxes between reservoirs are often depicted with a box model (Figure 1.3). The simplest cycle would involve two reservoirs, S_1 and S_2, between which fluxes are exchanged as $F_{1,2}$ and, vice versa, $F_{2,1}$. In steady state conditions, the following equation holds:

$$\frac{dS_1}{dt} = F_{1,2} - F_{2,1} = 0 \tag{1.3}$$

In practice, all (bio)geochemical cycles have components, or storage reservoirs, on land, in the ocean and in the atmosphere, thus adding a third reservoir to our simple box model. This adds complexity in the form of new exchange and return fluxes, as now six fluxes are important rather than two. It is difficult to generalize this, as adding new components generally involves exchanges with one or two of the other reservoirs only. The interplay between such a set of exchange fluxes determines the complexity and stability of a cycle, as feedbacks may be strengthened or weakened by changes in the size of the fluxes.

An important descriptor of the functioning of a cycle is the ratio between the size of the reservoir (i.e. the mass) and the flux. If the fluxes are small compared to the size of the reservoir, the process generally has little implication at short timescales. The reverse is true if the flux is large compared to the size of the reservoir. This ratio is called the turnover time. This is equivalent to the mean residence time under steady state conditions and represents the average time it takes for a molecule to pass through the reservoir (e.g. Bolin & Rodhe, 1973). The mean residence time, τ, is calculated as the ratio of the mass of the reservoir to the sum of either input or output fluxes and assumes steady state conditions:

$$\tau = \frac{S_1}{F_{1,2}} \tag{1.4}$$

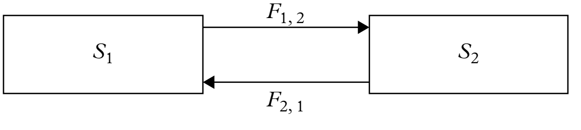

Figure 1.3 *Schematic drawing of a very simple geological cycle with two reservoirs and two reciprocal exchange fluxes*

Table 1.1 *The fluxes, reservoir sizes and calculated the mean residence time (τ) for key reservoirs of the carbon cycle. (Values from Ciais et al., 2013)*

Reservoir	Flux (Pg C yr^{-1})	Size of Reservoir (Pg C)	τ (years)
Atmosphere	190	589	3.1
Ocean	80	40000	500.0
Land vegetation	123	525	4.3
Soils	47	950	41.0

In Table 1.1 the magnitude of the fluxes and reservoirs of the carbon cycle are given and used to calculate the mean residence times, to indicate the stability of carbon in the reservoirs. As the sizes of the fluxes and the reservoirs are similar, the lowest mean residence times for carbon are obtained for the atmosphere and the vegetation. The ocean reservoir—given its enormous size—has a mean residence time for carbon of 500 years for a molecule of carbon dioxide. It is important to realize that, although the lifetime of an individual molecule of carbon dioxide in the atmosphere is relatively short, in most cases this simply implies that a molecule is taken up by the ocean and land, and another molecule swapped back. For the warming potential of carbon dioxide, the mean residence times of carbon in the reservoirs are thus less important than the absolute amounts.

The processes ensuring the uptake of carbon by vegetation and ocean are critically important in determining the rate of change of the atmospheric carbon stock, and hence climate change. We can illustrate this further by showing the impact of mean residence times on the change of the size of the reservoirs after an initial pulse of carbon dioxide for the normalized change in atmospheric content since the industrial revolution. Figure 1.4 shows how the initial uptake takes place within the reservoir with the fastest response time, in this case, the land system (taken as the mean residence time for soils, from Table 1.1). We assume that

$$\frac{dS}{dt} = \beta S \tag{1.5a}$$

$$S = S_0 e^{-\beta t} \tag{1.5b}$$

which shows that the rate of change in reservoir S, the atmosphere, in our case, is assumed to be proportional to a constant β times the size of the reservoir. The mean residence time is then the reciprocal of this constant. Note also that the mean residence time is equivalent to the time it takes to drop to $0.31S$, that is, $1/e$ of the initial value S_0. In this extremely simplified model, it would thus take the land about two hundred years to get rid of the assumed pulse of anthropogenic carbon dioxide, provided it continues to take up carbon. This is, of course, not quite realistic, because of the ultimately limited capacity of the biosphere to absorb carbon. So, the decline will be much less rapid and, importantly, feedbacks exist between the organic part of the carbon cycle and climate, through the temperature and moisture sensitivity of respiration and photosynthesis,

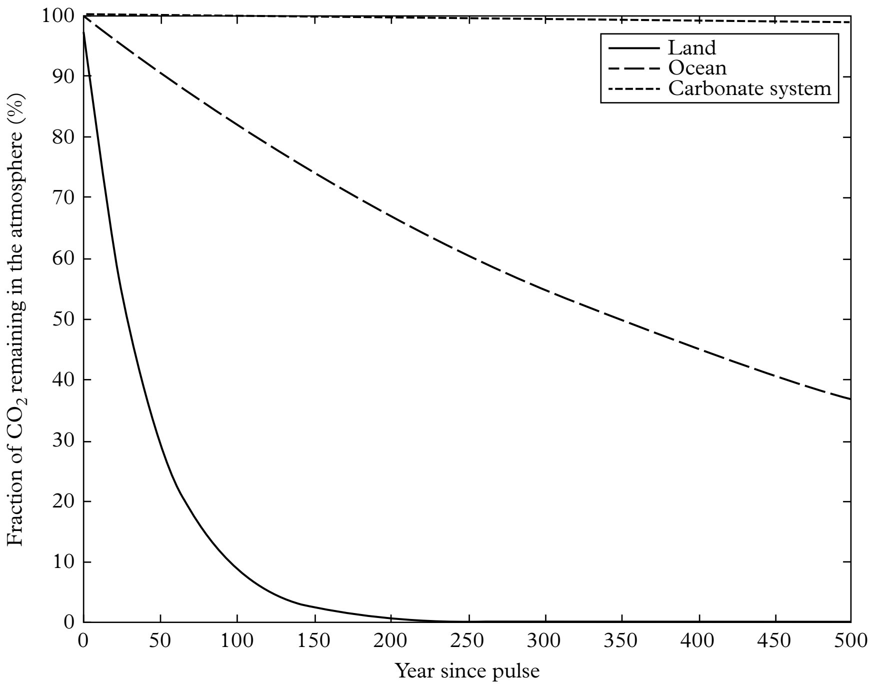

Figure 1.4 *Removal of carbon dioxide, expressed as the fraction of carbon dioxide remaining in the reservoir after an initial pulse (100%) is fed through the main reservoirs: land, deep ocean and the carbonate system. The mean residence times used are based on the values given in Table 1.1 and a simple first-order differential equation in which the removal rate is set proportional to the size of the reservoir and the reciprocal of the mean residence time, that is, eqns (1.5a) and (1.5b).*

which renders this rough calculation even less accurate. The deep ocean removes carbon at much longer timescales. At even longer, geological timescales, inorganic carbonate sedimentation moves carbon from the ocean into the crust: these processes would take several tens or hundreds of thousands of years to remove the pulse of human carbon dioxide. Over the first 500 years after the pulse, this system would only remove 1% of the initial pulse.

This model does not take into account the full buffering capacity of the ocean's carbonate system. This may make the uptake of carbon considerable less than estimated here (see Chapter 9). Despite these caveats, the calculations make several important points. In the long term, Earth will recover from the pulse of fossil fuel emission humans have injected into the atmosphere, initially through the action of both the land and the oceans, and later primarily through the action of the larger reservoir, the ocean. However, limits exist to the uptake capacity and rate of these systems; for the oceans, this will be a very slow process. Interestingly, the uptake of carbon by land and ocean currently takes 'care' of about half our emissions, preventing a much stronger heating of the planet. We will explore this feedback in more detail in Chapters 9 and 13.

Exploring the Variety of Random Documents with Different Content

ordinaria al destro et inalbor[an]do il destro in[an]zi, farai una meza Capriola di Cad[en]za, c[on] una Capriola quarta; e cosi potrai fare [per] contrario.

Mutanza XIII. Tempo Primo.

Hau[en]do il Piè sinistro indietro in Passo naturale, farai una spacchata [per] fi[an]co à lato destro, poi col destro farai una recacciata al sinistro in uolta à lato destro, et inalborando il sinistro [per] fi[an]co, farai un passo in aria, in uolta à lato destro, e torn[an]do in Prospettiua, inalborarai il destro in[an]zi, e farai una Cadenza.

Secondo Tempo.

Nel secondo tempo farai un striscio in uolta à lato destro, e col destro farai una recacciata al sinistro in uolta à lato destro, et inalbor[an]do il sinistro [per] fi[an]co, farai un passo in aria in uolta, à lato destro, e torn[an]do in Prospettiua, inalborarai il destro inanzi, e farai una Cad[en]za, c[on] una Capriola quarta, e cosi potrai fare [per] contrario.

Mut[an]za XIV. Tempo Primo.

Essendo il Piè sinistro indietro in Passo naturale, farai una Capriola quinta, et uno striscio in uolta à lato destro, e col piè destro, farai una recacciata ordinaria al sinistro in uolta à lato destro, et inalbor[an]do il sinistro [per] fi[an]co, farai un passo in aria in uolta à lato destro, e torn[an]do in Prospettiua inalborarai il destro in[an]zi, e farai una meza Capriola di Cad[en]za.

Secondo Tempo.

Nel sec[on]do t[em]po, farai un striscio in uolta à lato destro, et una spacchata recacciata col destro al sinistro, in uolta à lato destro, e

torn[an]do in Prospettiua, inalborarai il sinistro in[an]zi, e farai un passo in aria, et inalbor[an]do il destro in[an]zi, farai una Cad[en]za, con un salto tondo in uolta à lato destro, e nel fine ti ritrouerai in Prospettiua, e col piè destro indietro, in passo naturale; e cosi potrai fare [per] c[on]trario.

Mut[an]za XV. Primo Tempo.

Hau[en]do il Piè sinistro indietro in Passo naturale, darai un sottopiede al destro, et inalbor[an]do in[an]zi d.º destro, farai due meze Capriole di passo in aria, una col destro, l'altra col sinistro, e col destro c[he] si trouarà inalborato in[an]zi, farai una sincopa, et una Capriola terza di piede in aria, et una meza Capriola di Cad[en]za.

Sec[on]do Tempo.

Nel sec[on]do t[em]po farai col sinistro un sottopiede Cromatico in uolta à lato destro, poi col sinistro, farai un passo incrociato al destro in uolta à lato destro, e col destro darai un sottopiede al sinistro, et inalbor[an]do d.º sinistro [per] fi[an]co, farai un passo in aria in uolta à lato destro, e torn[an]do in prospettiua inalborarai il destro in[an]zi, e farai una Cad[en]za.

Mut[an]za XVI. Primo Tempo.

Ess[en]do il Piè sinistro indietro in Passo naturale; farai una Cad[en]za ritornata, et una cambiata de piede, c[on] un striscio in uolta à lato destro, et una recacciata col piè destro al sinistro in uolta à lato destro, e torn[an]do in Prospettiua, inalborarai il sinistro in[an]zi, e farai una Cad[en]za.

Secondo Tempo.

Nel secondo tempo, farai una finta in[an]zi, et incrocierai il destro dietro al sinistro, e scroci[an]dolo tornerai ad incrociarlo in[an]zi al sinistro, poi lasci[an]dolo callare, farai un passo naturale in[an]zi, e col sinistro darai un sottopiede al destro, et inalbor[an]do il destro in[an]zi, farai un passo in aria, et inalbor[an]do il sinistro in[an]zi, farai una Cad[en]za.

Terzo Tempo.

Nel terzo tempo, farai una finta in[an]zi, et una recacciata col destro al sinistro in uolta à lato destro, poi col sinistro, c[he] si trouerà inalborato [per] fi[an]co farai un G[an]zo rouerso col destro darai un sottopiede al sinistro, et inalbor[an]do d.º sinistro in[an]zi, farai con esso una recacciata ordinaria al destro, et inalbor[an]do il destro in[an]zi, farai c[on] esso un soprapiede ordinario al sinistro, e col sinistro darai un sottopiede Cromatico al destro, et inalbor[an]do il destro in[an]zi, farai un zoppetto, et una meza Capriola di Cad[en]za; e cosi potrai fare [per] contrario.

Mut[an]za XVII. Tempo Primo.

Hauendo il Piè sinistro indietro in passo naturale, darai c[on] esso un sottopiede al destro, et inalbor[an]do il destro in[an]zi, farai una Cad[en]za di zoppetto, poi sping[en]do in[an]zi il sinistro, farai un soprapiede minimo al destro, e col destro darai un sottopiede minimo al sinistro, et inalbor[an]do d.º sinistro in[an]zi, farai un passo in aria, et inalbor[an]do il destro in[an]zi, farai una Cad[en]za.

Secondo Tempo.

Nel secondo tempo, darai col destro un sottopiede al sinistro, et inalbor[an]do il sinistro in[an]zi farai un zoppetto, et una recacciata ordinaria col sinistro al destro, et inalbor[an]do il destro in[an]zi, farai un zoppetto, et un passo in aria, et inalbor[an]do il sinistro in[an]zi, farai una Cadenza.

Terzo Tempo.

Nel terzo tempo, darai col sinistro un sottopiede al destro, et inalbor[an]do il destro in[an]zi, farai un zoppetto, et un passo in uolta à lato destro, poi col sinistro, farai un passo incrociato al destro in uolta à lato destro, e col destro darai un sottopiede al sinistro, et inalbor[an]do d.º sinistro [per] fi[an]co, farai un passo in aria in uolta à lato destro, e torn[an]do in prospettiua inalborarai il destro in[an]zi, e farai una Cad[en]za.

Mut[an]za XVIII. Primo Tempo.

Ess[en]do il Piè sinistro indietro in Passo naturale; farai una Cad[en]za ritornata, et una cambiata de piede, c[on] un striscio in uolta à lato destro, et una recacciata col piè destro al sinistro in uolta à lato destro, e torn[an]do in Prospettiua, inalborarai il sinistro in[an]zi, e farai una Cad[en]za.

Secondo Tempo.

Nel secondo tempo, farai una finta in[an]zi, et incrocierai il destro dietro al sinistro, e scroci[an]dolo, tornerai ad incrociarlo in[an]zi al sinistro, poi lasci[an]dolo callare, farai un passo naturale in[an]zi, e col sinistro darai un sottopiede al destro, et inalbor[an]do il destro in[an]zi, farai un passo in aria, et inalbor[an]do il sinistro in[an]zi, farai una Cad[en]za.

Terzo Tempo.

Nel terzo tempo, farai una finta in[an]zi, et una recacciata col destro al sinistro in uolta à lato destro, poi col sinistro, c[he] si trouerà inalborato [per] fi[an]co farai un G[an]zo rouerso in uolta à lato destro, e col sinistro, c[he] si trouarà inalborato indietro, darai un sottopiede al destro, in uolta à lato destro, e torn[an]do in

Prospettiua, inalborerai il destro in[an]zi, e farai una meza Capriola di Cad[en]za, e cosi potrai fare [per] c[on]trario.

Mut[an]za XVIIII. Primo Tempo.

Ess[en]do il Piè sinistro indietro in passo naturale, farai due riprese à lato sinistro, e col sinistro, c[he] si trouarà inalborato in[an]zi farai una recacciata ordinaria al destro, et inalbor[an]do il destro in[an]zi, farai un zoppetto, et una Cad[en]za.

Secondo Tempo.

Nel secondo tempo, farai col sinistro un soprapiede Cromatico al destro, e col destro darai un sottopiede Cromatico al sinistro, et inalbor[an]do il sinistro farai un passo naturale in[an]zi, e sping[en]do il destro [per] fi[an]co, farai una ripresa à lato destro, e col destro, c[he] si trouerà inalborato in[an]zi, farai un passo in aria, et inalbor[an]do il sinistro in[an]zi, farai una Cadenza.

Terzo Tempo.

Nel terzo t[em]po, farai un fioretto in uolta à lato destro, e col piè destro darai un sottopiede al sinistro, et inalbor[an]do il sinistro [per] fi[an]co, farai un zoppetto in uolta à lato destro, et un passo in aria in uolta à d.º lato, e torn[an]do in Prospettiua, inalborarai il destro in[an]zi, e farai una Cad[en]za, e cosi potrai fare [per] contrario.

Mutanza XX. Tempo Primo.

Hau[en]do il piè sinistro indietro in passo naturale, farai col destro una recacciata ordinaria al sinistro, et inalbor[an]do il sinistro in[an]zi, farai una recacciata ordinaria al destro, et inalbor[an]do il destro in[an]zi, farai con esso una recacciata ordinaria al sinistro, et

inalbor[an]do il sinistro inanzi, farai un zoppetto Cromatico, et un passo in aria, et inalbor[an]do il destro in[an]zi, farai una Cad[en]za.

Secondo Tempo.

Nel secondo tempo, farai una c[am]biata de piedi, et un striscio in uolta à lato sinistro, e col piè sinistro farai una recacciata al destro in uolta à lato sinistro, et inalbor[an]do il destro [per] fi[an]co, farai un passo in aria in uolta à lato sinistro e tornando in Prospettiua, inalborerai il sinistro in[an]zi, e farai una Cad[en]za.

Terzo Tempo.

Nel terzo t[em]po, darai col sinistro un sottopiede al destro et inalbor[an]dolo in[an]zi, farai una Cad[en]za di zoppetto, poi col sinistro darai un sottopiede al destro, et inalbor[an]do il destro in[an]zi, farai c[on] esso una recacciata al sinistro in uolta à lato destro, et inalbor[an]do il sinistro [per] fi[an]co, farai un passo in aria in uolta à lato destro, e tornando in Prospettiua, inalborarai il destro in[an]zi, e farai una Cad[en]za, c[on] una Capriola qu[in]ta, e cosi potrai fare [per] contrario.

Mut[an]za XXI. Tempo Primo.

Essendo il Piè sinistro indietro in Passo naturale, farai un zoppetto incrociato dietro al destro, e c[on] d.º sinistro darai un sottopiede al destro, et inalbor[an]do d.º destro in[an]zi, farai c[on] esso una recacciata al sinistro in uolta à lato destro, et inalbor[an]do il sinistro in[an]zi, farai un zoppetto in uolta à lato destro, e torn[an]do in Prospettiua, farai un passo in aria e inalborarai il destro in[an]zi, e c[on] esso farai una Cad[en]za.

Secondo Tempo.

Nel secondo tempo, farai un fioretto ordinario, et una recacciata col destro al sinistro in uolta à lato destro, et inalbor[an]do il sinistro [per] fi[an]co, farai un passo in aria in uolta à lato destro, e torn[an]do in Prospettiua inalborarai il destro in[an]zi, e farai una Cad[en]za.

Terzo Tempo.

Nel terzo tempo, farai un striscio in uolta à lato destro, e col destro farai una recacciata al sinistro in uolta à lato destro torn[an]do in Prospettiua, et inalbor[an]do il sinistro in[an]zi, farai un passo in aria, et inalbor[an]do il destro in[an]zi, farai una Cad[en]za, c[on] una Capriola quarta; e cosi potrai fare [per] contrario

Mut[an]za XXII. Primo Tempo.

Hau[en]do il Piè sinistro indietro in Passo naturale, farai un trabocchetto [per] fi[an]co à lato sinistro, et uno à lato destro, e nel istesso t[em]po inalborarai il sinistro inanzi, e farai un zoppetto, et un passo in aria, et inalbor[an]do il destro inanzi, farai una Cad[en]za.

Secondo Tempo.

Nel secondo tempo, farai un trabocchetto [per] fianco à lato destro, e sping[en]do in[an]zi il sinistro, farai una Cad[en]za, c[on] uno striscio in uolta à lato sinistro e col sinistro farai una recacciata al destro in uolta à lato sinistro e torn[an]do in Prospettiua inalborarai il destro in[an]zi, e farai un passo in aria, et inalbor[an]do il sinistro inanzi, farai una Cadenza.

Terzo Tempo.

Nel terzo tempo spingerai in[an]zi il sinistro, e farai un zoppetto, et un passo in uolta à lato sinistro, poi inalz[an]doti sù la punta del piè

sinistro, farai una uolta, e meza di zurlo in uolta à lato sinistro, e torn[an]do in prospettiua, farai col destro una Cad[en]za, c[on] una Capriola quarta, e cosi potrai fare [per] contrario.

Mut[an]za XXIII. Primo Tempo.

Ess[en]do il Piè sinistro indietro in Passo naturale, farai un passo in uolta à lato destro, e col piè destro, darai un sottopiede al sinistro, et inalbor[an]do d.º sinistro [per] fi[an]co, farai un Ganzo rouerso in uolta à lato destro, e ten[en]do inalborato d.º sinistro indietro, darai c[on] esso un sottopiede al destro in uolta à lato destro, e torn[an]do in Prospettiua inalborarai il destro in[an]zi, e farai una Cadenza.

Secondo Tempo.

Nel secondo tempo, farai una Cadenza ritornata, et un striscio in uolta à lato destro, e col piè destro farai una recacciata al sinistro in uolta à lato destro, e torn[an]do in Prospettiua, et inalbor[an]do il sinistro in[an]zi, farai una meza Capriola di passo in aria, et inalborando il destro in[an]zi, farai una Cadenza di zoppetto.

Terzo Tempo.

Nel terzo tempo, farai un passo incrociato in uolta, à lato destro, e col piè destro darai un sottopiede al sinistro, et inalbor[an]do d.º sinistro [per] fi[an]co, farai un Passo in aria Cromatico in uolta à lato destro, et inalbor[an]do il destro in[an]zi, farai una meza Capriola di Cadenza c[on] una Capriola quarta, e cosi potrai fare [per] contrario.

Mut[an]za XXIIII. Primo Tempo.

Hau[en]do il Piè sinistro indietro in Passo naturale, farai una cambiata de Piede e col destro darai un sottopiede col sinistro, et inalborarai d.º sinistro [per] fi[an]co, e farai una ripresa à lato

sinistro, e col sinistro, c[he] si trouarà inalborato in[an]zi, farai un passo in aria, et inalbor[an]do il destro in[an]zi, farai una Cadenza.

Secondo Tempo.

Nel secondo tempo farai una recacciata ordinaria col sinistro al destro, et inalbor[an]do il destro in[an]zi, farai un Zoppetto, et una ripresa à lato destro, e c[on] esso destro, c[he] si trouarà inalborato in[an]zi, farai un passo in aria, et inalbor[an]do il sinistro in[an]zi, farai una Cadenza.

Terzo tempo.

Nel terzo tempo, farai una Capriola terza, et un balzetto indietro, stando c[on] la faccia in Prospettiua, poi col sinistro farai una recacciata ordinaria al destro, et inalbor[an]do d.º destro in[an]zi, farai un passo in aria, et inalbor[an]do il sinistro in[an]zi, farai una meza Capriola di cad[en]za, c[on] una Capriola terza, e cosi potrai fare [per] contrario.

Mutanza XXV. Primo Tempo.

Ess[en]do il Piè sinistro indietro in Passo naturale, farai una ripresa à lato sinistro, e col sinistro, c[he] si trouarà inalborato in[an]zi, farai una spacchata ricacciata, col sinistro al destro, et inalbor[an]do il destro in[an]zi, farai un zoppetto, et una meza Capriola sul collo del piè sinistro di Cadenza.

Secondo Tempo.

Nel secondo t[em]po, darai un sottopiede col destro al sinistro, et inalbor[an]do d.º sinistro in[an]zi, ti uoltarai à lato sinistro, e farai due meze Capriole di passo in aria, una col sinistro, l'altra col destro, e col sinistro, c[he] si trouarà inalborato [per] fi[an]co, farai una recacciata al destro in uolta à lato sinistro, e torn[an]do in

Prospettiua, inalborarai il destro in[an]zi, e farai, una meza Capriola di passo in aria, et inalbor[an]do il sinistro inanzi, farai una meza Capriola di Cadenza.

Terzo Tempo.

Nel terzo tempo, farai col destro una recacciata ordinaria al sinistro, et inalbor[an]do il sinistro inanzi, farai un passo in aria, et inalbor[an]do il destro inanzi, farai una meza Capriola di Cad[en]za, c[on] una Capriola quarta, e cosi potrai fare [per] contrario.

Mut[an]za XXVI. Primo Tempo.

Hau[en]do il Piè sinistro indietro in Passo naturale, farai un fioretto ordinario, et un balzetto indietro, st[an]do c[on] la faccia in Prospettiua, poi farai una recacciata ordinaria col sinistro al destro, et inalbor[an]do il destro in[an]zi farai una Cad[en]za di zoppetto.

Secondo Tempo.

Nel secondo tempo, darai un sottopiede col sinistro al destro, et una spacchata recacciata col destro al sinistro in uolta à lato destro, et inalbor[an]do il sinistro [per] fi[an]co, farai un passo in aria in uolta à lato sinistro, e torn[an]do in Prospettiua inalborarai il destro in[an]zi, e farai una meza Capriola di Cad[en]za.

Terzo Tempo.

Nel terzo tempo, farai dui fioretti tagliati, et una recacciata ordinaria col sinistro al destro, et inalbor[an]do d.º destro in[an]zi, farai una Cad[en]za, c[on] una Capriola quarta, e cosi potrai fare [per] contrario.

Mut[an]za XXVII. Primo Tempo.

Essendo il Piè sinistro indietro in Passo naturale, farai una spacchata in[an]zi, e col sinistro darai un sottopiede al destro et inalbor[an]do in[an]zi d.º destro, farai c[on] esso una recacciata ordinaria al sinistro, et inalbor[an]do d.º sinistro in[an]zi, farai un passo in aria, et inalbor[an]do il destro in[an]zi, farai una Cadenza.

Secondo Tempo.

Nel secondo tempo, farai una Campanella indietro, et in[an]zi in uolta à lato sinistro, e col sinistro, c[he] si trouarà inalborato [per] fi[an]co, farai una recacciata al destro in uolta à lato sinistro, e torn[an]do in Prospettiua, inalborarai il destro in[an]zi, e farai un passo in aria, et inalbor[an]do il sinistro in[an]zi, farai una meza Capriola di Cad[en]za.

Terzo Tempo.

Nel terzo tempo, spingerai in[an]zi il sinistro, e farai una Cad[en]za di zoppetto in[an]zi, et una recacciata col sinistro al destro in uolta à lato sinistro, et torn[an]do in Prospettiua, inalborarai il destro in[an]zi, e farai una Cad[en]za à piedi pari, c[on] una Capriola intrecciata di Cadenza, col piè destro indietro in passo naturale, e cosi potrai fare [per] contrario.

Mut[an]za XXVIII. Primo Tempo.

Trou[an]dosi il Piè sinistro indietro in Passo naturale, farai un G[an]zo in uolta, à lato destro, e col destro, c[he] si trouarà inalborato [per] fi[an]co farai una meza Capriola di passo in aria in uolta à lato destro, e torn[an]do in Prospettiua, inalborarai il sinistro in[an]zi, e farai un passo in aria, et inalbor[an]do il destro in[an]zi, farai una Cad[en]za, c[on] una Capriola quarta.

Secondo Tempo.

Nel secondo tempo, farai un striscio in uolta à lato destro, et una cambiata de piede, poi tornerai à fare un striscio in uolta à lato destro, et una recacciata col destro al sinistro in uolta à lato destro, e torn[an]do in Prospettiua, inalborarai il sinistro in[an]zi, e farai un zoppetto, et una Cad[en]za.

Terzo Tempo.

Nel terzo tempo, farai una Capriola terza, et un striscio in uolta à lato destro, e col piè destro, farai una recacciata al sinistro in uolta à d.º lato destro, e tornando in prospettiua, inalborarai il sinistro in[an]zi, e farai una meza Capriola di passo in aria, et inalbor[an]do il destro in[an]zi, farai una meza Capriola di Cad[en]za, c[on] una Capriola quarta, e cosi potrai fare [per] contrario.

Mut[an]za XXIX. Primo Tempo.

Ess[en]do il Piè sinistro indietro in Passo naturale, farai un fioretto tagliato in uolta à lato destro, et un striscio in uolta à d.º lato, e torn[an]do in Prospettiua, farai una recacciata ordinaria col destro al sinistro, et inalbor[an]do il sinistro in[an]zi, farai una meza Capriola di passo in aria, et inalbor[an]do il destro in[an]zi, farai una Cad[en]za.

Secondo Tempo.

Nel secondo tempo, farai una Capriola terza, et una recacciata col destro al sinistro in uolta à lato destro, et inalbor[an]do il sinistro [per] fi[an]co, farai un passo in aria in uolta à d.º lato destro, e torn[an]do in Prospettiua, inalborarai il destro in[an]zi, e farai una Cad[en]za.

Terzo Tempo.

Nel terzo tempo; farai col sinistro un soprapiede Cromatico al destro, e col destro darai un sottopiede Cromatico al sinistro e con d.º sinistro, farai un passo Cromatico in[an]zi, et un striscio in uolta à lato destro, con un salto tondo d'una uolta, e meza, e nel fine di d.º salto ti ritrouerai in Prospettiua, e col piè destro indietro in passo naturale; e cosi potrai fare [per] contrario.

Mut[an]za xxx. Primo Tempo.

Hau[en]do il Piè sinistro indietro in Passo naturale, farai una Capriola terza, e tre incrociate di gamba, col destro al Sinistro, una in dietro, una in[an]zi, et una indietro, e col destro, c[he] si trouarà inalborato indietro, darai un sottopiede al sinistro, et inalbor[an]do d.º sinistro in[an]zi, farai un passo in aria, et inalbor[an]do il destro in[an]zi, farai una Cad[en]za.

Secondo Tempo.

Nel secondo tempo, farai col sinistro una recacciata ordinaria al destro, et inalbor[an]do d.º destro in[an]zi, farai un zoppetto, et un sottopiede Cromatico al sinistro, e col sinistro darai un sottopiede al destro, et inalbor[an]do d.º destro in[an]zi, farai una Cad[en]za, c[on] una Capriola quarta.

Terzo Tempo.

Nel terzo tempo, farai una Capriola terza, e col sinistro farai una recacciata al destro in uolta à lato sinistro, e torn[an]do in Prospettiua, inalborarai il destro in[an]zi, e farai una Cad[en]za à piedi pari, c[on] una Capriola intrecciata di Cad[en]za, rest[an]do col piè destro in dietro in passo naturale; e cosi potrai fare [per] c[on]trario.

Mutanza xxxi fatta in quattro tempi di Gagliarda.

Primo Tempo.

Trou[an]dosi il Piè sinistro in dietro in passo naturale, darai col sinistro un sottopiede al destro, et inalborando il destro in[an]zi, farai dui zoppetti, et un soprapiede col destro al sinistro, et inalbor[an]do il sinistro indietro lo spingerai, e farai un Zoppetto c[on] una meza Capriola di Cadenza.

Secondo Tempo.

Nel secondo tempo, farai col sinistro un zoppetto, et un passo naturale in[an]zi, e poi col destro farai una meza Capriola di Cad[en]za ritornata; c[on] una Capriola quarta.

Terzo Tempo.

Nel terzo tempo, farai dui balzetti indietro in uolta à lato destro, e col piè sinistro farai un passo trangato in uolta à lato destro, e torn[an]do in Prospettiua, farai una Capriola quarta.

Quarto Tempo.

Nel quarto tempo, farai una Capriola quinta, et un salto tondo spacchato, recacciato col sinistro al destro in uolta à lato destro, e torn[an]do in Prospettiua col destro in[an]zi, et in passo naturale, farai una Capriola quarta, e cosi potrai fare [per] contrario.

Mut[an]za XXXII. Primo Tempo.

Hau[en]do il Piè sinistro indietro in Passo naturale, farai una Capriola quinta di piede in aria, et il sinistro, c[he] si trouarà inalborato in[an]zi, lo posarai in passo naturale, e poi col destro farai un altro passo naturale in[an]zi, et sp[in]g[en]do, et inalbor[an]do in[an]zi il sinistro farai una Cad[en]za ritornata strisciata.

Secondo Tempo.

Nel secondo tempo, uolterai indietro il fi[an]co sinistro, e farai una spacchata à lato sinistro, e col piè destro, darai un sottopiede al sinistro, et inalbor[an]do d.º sinistro indietro, farai una meza Capriola di passo in aria in uolta à lato sinistro, et inalbor[an]do il destro [per] fi[an]co, farai c[on] esso un passo incrociato al sinistro in uolta à lato sinistro, e torn[an]do in Prospettiua, farai col sinistro un passo strisciato in[an]zi.

Terzo Tempo.

Nel terzo tempo, farai due meze Capriole di passo in aria, una col destro l'altra col sinistro, in uolta à lato destro, poi col sinistro, c[he] si trouarà inalborato [per] fi[an]co, farai un passo in uolta à lato destro, e sping[en]do in[an]zi il sinistro, farai un passo strisciato in uolta à lato destro, e tornerai in Prospettiua.

Quarto Tempo.

Nel quarto tempo, spingerai, et inalborerai il destro in[an]zi, e farai una meza Capriola di Cad[en]za ritornata, e torn[an]do, e inalbor[an]do, il destro in[an]zi, farai una Cad[en]za ritornata, c[on] una Capriola quarta, e cosi potrai fare [per] c[on]trario.

Mut[an]za XXXIII. Primo Tempo.

Ess[en]do il Piè sinistro indietro in Passo naturale, farai col destro una recacciata al sinistro in uolta à lato destro, et inalbor[an]do il sinistro [per] fianco, farai un passo in aria semiminimo in uolta à lato destro, e torn[an]do in Prospettiua, inalborarai il destro in[an]zi, e farai una meza Capriola di Cad[en]za, c[on] una Capriola quarta.

Secondo Tempo.

Nel secondo tempo, farai due spacchate incrociate in[an]zi una col destro, e una col sinistro, et inalbor[an]do il destro in[an]zi, farai una Cadenza.

Terzo Tempo.

Nel terzo tempo, farai col sinistro un Corintho indietro, st[an]do c[on] la faccia in Prospettiua, et inalbor[an]ndo il destro in[an]zi, farai un passo in aria, et inalbor[an]do il sinistro inanzi, farai una Cadenza.

Quarto Tempo.

Nel quarto t[em]po darai un sottopiede col sinistro al destro, et inalbor[an]do il destro in[an]zi, farai un zoppetto, et un passo in uolta à lato destro, poi col piè sinistro farai un passo strisciato incrociato al destro in uolta à lato destro, e torn[an]do in Prospettiua, inalborarai il destro in[an]zi, e farai una Cadenza di zoppetto, c[on] una Capriola quarta, e cosi potrai fare [per] contrario.

Mut[an]za XXXIIII. Primo Tempo.

Hau[en]do il Piè sinistro indietro in Passo naturale, darai c[on] esso un sottopiede al destro, et inalbor[an]do il destro in[an]zi, farai dui zoppetti, e poi posarai d.º destro in Passo naturale in[an]zi, e col sinistro, farai una Cad[en]za ritornata finta.

Secondo Tempo.

Nel secondo tempo, farai una Cad[en]za di zoppetto in[an]zi, e col destro darai un sottopiede al sinistro, et inalbor[an]do d.º sinistro in[an]zi, farai un zoppetto, e lo posarai in passo naturale, poi sping[en]do in[an]zi il destro, farai una Cadenza ritornata finta.

Terzo Tempo.

Nel terzo tempo, farai col destro tre zoppetti incrociati, uno in dietro, uno in[an]zi, et uno in dietro, e col destro, c[he] si trouarà inalborato indietro, darai un sottopiede al sinistro, et inalbor[an]do il sinistro in[an]zi, farai una Cad[en]za [per] fianco à lato destro.

Quarto Tempo.

Nel quarto tempo, farai un trito minuto in dietro, et un passo incrociato col sinistro al destro in uolta à lato destro, e col piè destro, darai un sottopiede al sinistro, et inalbor[an]do il sinistro in[an]zi, tornerai in Prospettiua, e farai un passo in aria, et inalbor[an]do il destro in[an]zi, farai una Cadenza.

Mut[an]za XXXV. Primo Tempo.

Ess[en]do il Piè sinistro indietro in Passo naturale, farai un G[an]zo in uolta à lato destro, e col destro, c[he] si trouarà inalborato [per] fi[an]co, farai un passo naturale indietro, poi col sinistro farai un passo incrociato in uolta à lato destro, e col piè destro, darai un sottopiede al sinistro, e torn[an]do in prospettiua, inalborarai il sinistro in[an]zi, e farai un passo in aria, et inalbor[an]do il destro in[an]zi, farai una meza Capriola di passo in aria.

Secondo Tempo.

Nel secondo tempo, col sinistro c[he] si trouarà inalborato in[an]zi, farai una meza Capriola di passo in aria, et inalbor[an]do il destro in[an]zi, farai un passo in aria, et inalborando il sinistro in[an]zi, farai una Cad[en]za, c[on] una Capriola quarta.

Terzo Tempo.

Nel terzo tempo, tornerai à fare il primo tempo della presente mut[an]za, cominci[an]do dal Ganzo, e fen[en]do c[on] la prima

meza Capriola di passo in aria.

Quarto Tempo.

Nel quarto tempo, col sinistro, c[he] si trouarà inalborato in[an]zi, farai due riprese semiminime à lato sinistro, e col sinistro, c[he] si trouarà inalborato in[an]zi, farai un passo in aria, et inalbor[an]do il destro in[an]zi, farai una Cad[en]za, con una Capriola quarta, e cosi potrai fare [per] contrario.

Mut[an]za XXXVI. Primo Tempo.

Hau[en]do il Piè sinistro indietro in Passo naturale, farai un balzetto [per] fi[an]co à lato destro; poi uolt[an]doti c[on] la persona à lato destro, farai col sinistro un passo trango in uolta à lato destro, et una Capriola quarta.

Secondo Tempo.

Nel sec[on]do tempo, farai una Capriola terza di piede in aria in uolta à lato destro, e col destro, c[he] si trouarà inalborato [per] fi[an]co, farai un passo in uolta à d.º lato destro, poi col sinistro darai un sottopiede al destro à d.º lato destro, et inalbor[an]do il destro [per] fi[an]co, farai una meza Capriola di passo in aria, et inalbor[an]do il destro per fi[an]co, farai una meza Capriola di passo in aria, et inalbor[an]do il sinistro [per] fi[an]co, farai un Zoppetto Cromatico.

Terzo Tempo.

Nel terzo tempo, col sinistro, c[he] si trouarà inalborato [per] fi[an]co, farai una meza Capriola di passo in aria à lato destro, et inalbor[an]do il destro [per] fi[an]co, farai con esso una recacciata al sinistro in uolta à lato destro, e torn[an]do in Prospettiua inalborarai

il sinistro in[an]zi, e farai un passo in aria, et inalbor[an]do il destro in[an]zi, farai una Cad[en]za.

Quarto Tempo.

Nel quarto tempo, farai una Capriola terza, et una recacciata in uolta à lato destro, col piè destro al sinistro, et inalbor[an]do il sinistro in[an]zi, farai un passo in aria Cromatico in uolta à lato destro, e torn[an]do in Prospettiua, inalborarai il destro in[an]zi, e farai una Cad[en]za, c[on] una Capriola quarta; e cosi potrai fare [per] contrario.

Mut[an]za XXXVII. Primo Tempo.

Trou[an]dosi il Piè sinistro indietro in Passo naturale, farai un Ganzo col destro in uolta à lato destro, e col piè destro farai un passo in uolta à lato destro, poi col sinistro farai un passo incrociato al destro in uolta, à lato destro, e col piè destro darai un sottopiede al sinistro, e torn[an]do in Prospettiua, inalborarai il sinistro in[an]zi, e farai un passo in aria Cromatico, e inalbor[an]do il destro in[an]zi, farai una Cad[en]za semiminima, c[on] una Capriola quarta.

Secondo Tempo.

Nel secondo tempo, farai una c[am]biata de piede, e col sinistro darai un sotto piede al destro, et inalbor[an]do il destro in[an]zi, farai una meza Capriola di passo in aria in uolta à lato destro, et inalbor[an]do il sinistro [per] fianco, farai una spacchata incrociata in uolta à lato destro, e torn[an]do in Prospettiua farai col sinistro, c[he] si trouarà inalborato in[an]zi un passo in aria Cromatico, et inalbor[an]do il destro in[an]zi, farai una Cad[en]za.

Terzo Tempo.

Nel terzo tempo, farai una Capriola quinta de piede in aria, e ten[en]do inalborato il destro in[an]zi, farai una Cad[en]za, et uno striscio in uolta à lato destro, e col destro farai una recacciata al sinistro in uolta a lato destro, e torn[an]do in Prospettiua inalborarai il sinistro in[an]zi, e farai una meza Capriola di Cad[en]za.

Quarto Tempo.

Nel quarto t[em]po, farai una Capriola quarta, et un striscio in uolta à lato destro, poi farai un passo tr[an]go alterato in uolta à lato destro, e torn[an]do in Prospettiua, farai un salto tondo in uolta à lato destro, e nel fine ti ritrouerai col piè destro in dietro in passo naturale, e cosi potrai fare [per] contrario.

Mut[an]za XXXVIII. Primo Tempo.

Hau[en]do il Piè sinistro indietro in Passo naturale, farai una spacchata in[an]zi, e col sinistro darai un sottopiede al destro, et inalbor[an]do il destro in[an]zi, farai un zoppetto, et un passo in aria; et inalbor[an]do il sinistro inanzi farai una Cad[en]za strisciata, e uoltarai la punta del sinistro indietro.

Secondo Tempo.

Nel secondo tempo, farai una spacchata indietro à lato sinistro, et inalbor[an]do il sinistro in[an]zi, farai un trabocchetto [per] fianco, et inalbor[an]do il destro indietro, farai un zoppetto in[an]zi, et una Cad[en]za.

Terzo Tempo.

Nel terzo tempo, farai una Capriola terza de piede in aria, e col destro, c[he] si trouarà inalborato in[an]zi, farai una Cad[en]za, et una Capriola terza de piede in aria, e col destro, c[he] si trouarà